

Appl. No. 10/006,578
Reply to Office action of 03/02/2005

REMARKS

Reconsideration of the above-referenced application in view of the above amendment, and of the following remarks, is respectfully requested.

Claims 1, 4-9, and 11-16 are pending in this case. Claims 1 and 9 are amended herein.

The Examiner rejected claims 1, 4-9, 11-16 under 35 U.S.C. § 103(a) as being unpatentable over Sandhu et al. (U.S. Patent 6,291,340) in view of Subrahmanyam et al. (U.S. Patent 6,693,030).

Applicant respectfully submits that amended claim 1 is patentable over Sandhu in view of Subrahmanyam et al as there is no disclosure or suggestion in the references of forming a conductive liner in a hole, annealing the conductive liner, after annealing the conductive liner, treating the conductive liner with hydrogen and then, forming a conductive barrier over the conductive liner. Sandhu teaches forming a titanium liner in a contact hole, converting a bottom portion of the liner to silicide by annealing, and forming a titanium nitride barrier over the liner. As noted by the Examiner, Sandhu does not teach treating the conductive liner with hydrogen. Subrahmanyam teaches performing a pre-clean prior to depositing a liner or barrier. Subrahmanyam further teaches that the precleaning can also be performed after depositing the barrier to "increase the electro migration resistance of the deposited Al, Cu, W, or other conductive metal which fills the feature." Thus, Subrahmanyam teaches precleaning to provide a cleaned surface on which to deposit the liner/barrier or cleaning the surface of the barrier to improve the interface between the barrier and conductive fill material. Subrahmanyam does not teach performing its precleaning between the liner and barrier depositions. There is no disclosure or suggestion in the

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references of forming a conductive liner in a hole, annealing the conductive liner, after annealing the conductive liner, treating the conductive liner with hydrogen and then, forming a conductive barrier over the conductive liner as required by the claim. Accordingly, Applicant respectfully submits that claim 1 and the claims dependent thereon are patentable over the references.

Applicant respectfully submits that claim 9 is patentable over Sandhu in view of Subrahmanyam as there is no disclosure or suggestion in the references of depositing titanium over a dielectric layer including within a contact hole, annealing the titanium, treating the titanium with hydrogen prior to the annealing step, and then, depositing TiN over the titanium. As discussed above Sandhu failed to teach treating the titanium with hydrogen. Subrahmanyam teaches performing a pre-clean prior to depositing a liner or barrier. Subrahmanyam further teaches that the precleaning can also be performed after depositing the barrier to "increase the electro migration resistance of the deposited Al, Cu, W, or other conductive metal which fills the feature." Thus, Subrahmanyam teaches precleaning to provide a cleaned surface on which to deposit the liner/barrier or cleaning the surface of the barrier to improve the interface between the barrier and conductive fill material. Subrahmanyam does not teach performing its precleaning between the liner and barrier depositions. There is no disclosure or suggestion in the references of forming a conductive liner in a hole, annealing the conductive liner, after annealing the conductive liner, treating the conductive liner with hydrogen and then, forming a conductive barrier over the conductive liner as required by the claim. Accordingly, Applicant respectfully submits that claim 9 and the claims dependent thereon are patentable over the references.

The other references cited by the Examiner have been reviewed, but are not felt to come within the scope of the claims as amended.

In light of the above, Applicant respectfully requests withdrawal of the Examiner's rejections and allowance of claims 1, 4-9, and 11-16. If the Examiner has any questions or other correspondence regarding this application, Applicant requests that the

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Examiner contact Applicant's attorney at the below listed telephone number and address.

Respectfully submitted,

A handwritten signature in black ink, appearing to be 'J. Garner', with a long horizontal line extending to the right.

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